present. They also showed that while the roots of *Coleus blumei* and *Heliotropium peruvianum* show injury in 3 days by an addition of 25 per cent nitrogen to the soil atmosphere, *Nerium oleander* is unharmed by 50 per cent of nitrogen, and the roots of *Salix* (*nigra?*) grow freely in pure nitrogen. Similar results were obtained by the use of helium instead of nitrogen as a diluting gas.

More recently BERGMAN[11] has found similar differences of response in the roots of land and swamp plants, the dead roots in the former often being replaced by others near the surface of the water, showing lack of aeration to be one of the most important factors involved. Several experiments serve to give emphasis to this fact. He found that land plants with submerged roots soon show pronounced wilting, the wilting being less marked when the submergence is in aerated water, and a reduction in transpiration preceding wilting. This is taken to indicate that absorption is reduced below the amount demanded by transpiration. When aeration is provided, the use of swamp water for submergence or watering gives no other harmful results than those obtained by the use of tap water or nutrient solutions. The oxygen content of swamp water in nature was found to be large in the open lakes examined, but to show decided decrease through the *Carex* stages to the *Chamaedaphne-Andromeda* and *Larix-Picea* stages. This leads to the conclusion that the mingling of hydrophytes, mesophtyes, and xerophytes in swamps is due to local differences in habitat, such as water level and aeration, affecting the rate of absorption and its ratio to transpiration; hence ecesis in swamps can occur only when the oxygen requirements of the species are satisfied.

These citations show that considerable descriptive matter has added materially to our knowledge of root systems, and that the few physiological investigations of these organs have pointed to wide diversity in the responses of individual species to changes in their environment.—GEO. D. FULLER.

Alpine vegetation of the central Andes.—HAUMAN[12] has recently described a scanty alpine vegetation found on the Andes between 31 and 37° south latitude, at elevations ranging from 2000 to 42,000 m. This region possesses many peaks above 6000 m. high, the highest and best known being Aconcagua, with an altitude of 7020 m. These mountains are snowcapped and possess a good development of glaciers, from which flow tortuous and variable streams, furnishing almost the entire water supply for the sparse vegetation, since the growing season in these mountains is almost entirely without rain. The temperature records are imperfect, but an important factor is the light frosts,

[11] BERGMAN, H. F., The relation of aeration to the growth and activity of roots and its influence on the ecesis of plants in swamps. Ann. Botany **34**:13–33. *fig. 3*. 1920.

[12] HAUMAN, LUCIEN, La végétation des hautes cordillères de Mendoza (République Argentine). Anales Soc. Cien. Argentina **86**:121–188. *pls. 5–22. figs. 7*. 1918.

which are common throughout the growing season. One station at 2700 m. gives an annual mean temperature 6.5, with a mean maximum of 13.4 and a mean minimum of 0.1° C. Humidity at all times is low, while wind velocity is decidedly high and constant. Precipitation as recorded at 2000 m. seems to be irregular and variable, the annual amounts ranging from 20 to 68 cm., occurring principally in the colder months in the form of snow. This deficiency of rainfall, combined with other factors, makes the vegetation not only very scanty, but limited to valleys and slopes which possess streams or seepage water from the glaciers and snowfields. In the absence of mountain lakes aquatic vegetation is scanty, and anything resembling mountain meadows is limited to the stream edges and small alluvial fans. Such grassy associations appear to resemble closely similar alpine areas elsewhere. Related to the alpine meadows are the "high Andean oases," formed at 3200 to 3600 m., where at the foot of talus or morainal slopes some alluvial soil has accumulated. These oases vary in size, but rarely reach 100 m. in diameter. They are often dominated by the juncaceous *Andesia bisexualis* 15 to 30 cm. high, forming a thick carpet.

Trees are absent throughout, and even in the valleys the shrubs do not exceed 2 m. in height. *Adesmia pinifolia* (a legume) is the most plentiful shrub; while among the others are *Ephedra americana andina*, *Berberis empetrifolia*, and *Senecio uspallatensis*. *Opuntia andicola*, the only cactus of the region, together with *Azorella Gilliesii* and *Laretia acaulis*, two umbellifers, form a curious trio of herbaceous cushion plants confined to the valleys.

Upon the more exposed parts of the mountains there is a notable abundance of prostrate, tufted, rosette, and cushion plants, often with a striking development of large woody roots. These growth forms are accounted for as being a response to exposure to high winds and dependence upon a subterranean water supply. Upon the slopes *Adesmia trijuga*, with shrubby cushions 30 cm. high, together with *Poa chilensis* and *Stipa speciosa* in tufts, dominate the area, forming scattered dots over the rocky landscape. Most abundant upon the summits between 3000 and 4000 m. are the subterranean woody cushions of *Adesmia subterranea*, whose leaves form a carpet upon the surface. Accompanying this species with similar growth forms are the more uncommon *Verbena uniflora* and *Oxalis bryoides*.

The entire vascular flora consists of 417 species, including one pteridophyte, *Cystopteris fragilis*, and one gymnosperm, *Ephedra*. Among the richest families are Compositae with 85 species, Leguminosae with 36, Gramineae with 34, Cruciferae with 28, Portulacaceae with 15, Umbelliferae with 15, Rosaceae with 12, Cyperaceae with 12, Oxalidaceae with 10, and Violaceae and Caryophyllaceae with 9 species each. Large genera are *Senecio* with 26 species, *Adesmia* with 16, *Calandrinia* with 15, *Astragalus* with 12, *Oxalis* with 10, and *Viola* with 9 species. The scarcity of the Saxifragaceae, with two rare species, and the entire absence of the Ericaceae and Primulaceae are worthy of note. Lichens, abundant at the lower altitudes, become very rare

above 2800 m.; mosses are common about springs up to 3600 m., but liverworts are entirely lacking. More than one-half the species (210) are classed as belonging to the central Andes, 60 being endemic. There are no endemic genera, but notable among this group are such aggregates as 6 species of *Adesmia*, 2 of *Boopis*, 12 of *Senecio*, and 2 new varieties of *Koeleria*. The other elements are the northern tropical with 16 species, the subtropical with 21 species, the basal Argentinian with 56 species, the southern Andean with 10 species, the Patagonian with 73 species, and the cosmopolitan and introduced species numbering respectively 28 and 17. This introduced element must be regarded as small when it is recalled that the Mendoza River valley has been the trans-Andean route for centuries.

Photographs and careful drawings of many of the interesting forms add much to the value of the report.—GEO. D. FULLER.

Crop centers.—A great service in unifying ecology and agriculture has recently been rendered by WALLER,[13] who has illustrated by well chosen examples the close relation that exists between crop and vegetation centers. TRANSEAU has shown how closely vegetation centers are indicated by a map showing the ratio of rainfall to evaporation, and WALLER now emphasizes the fact that corn, wheat, and similar crops show strikingly similar relations. It is often said that crops are moving west or north, which merely means for the most part that we are finding their range. For example, wheat was first cultivated away from its proper center, so that in the last 70 years the center of wheat cultivation has moved 700 miles west and 100 miles north. A fundamental difference between crops and native plants is that when the latter extend far beyond their range, it is chiefly in the poorest soil, since competition with plants proper to the district exclude them elsewhere. Crops grown at the edge of their range, however, must be grown in the best conditions available, and of course are exempt from competition. Special attention is paid to corn, wheat, and cotton, and the maps showing their distribution are very significant. Of course there are many complexities in working out the thesis. Economic considerations, such as problems of market and transportation, figure very largely. Considering its origin, the center of corn might be sought south; competition with cotton is thought to be the major factor here. The dominance of eastern Illinois in corn production, and of North Dakota in the production of spring wheat, are related to edaphic factors; in each case there is rich prairie soil.—H. C. COWLES.

Increasing catalase activity in yeast cells.—EULER and BLIX[14] have determined the effect of various conditions and reagents upon the catalase activity

[13] WALLER, A. E., Crop centers of the United States. Jour. Amer. Soc. Agron. **10**:49–83. *figs. 8.* 1918.

[14] EULER, H. V., and BLIX, R., Verstärkung der Katalasewirkung in Hefezellen. Hoppe-Seyler Zeit. Physiol. Chem. **105**:83–114. 1919.